PDR Preparation

MO & DA Review
7/24/01

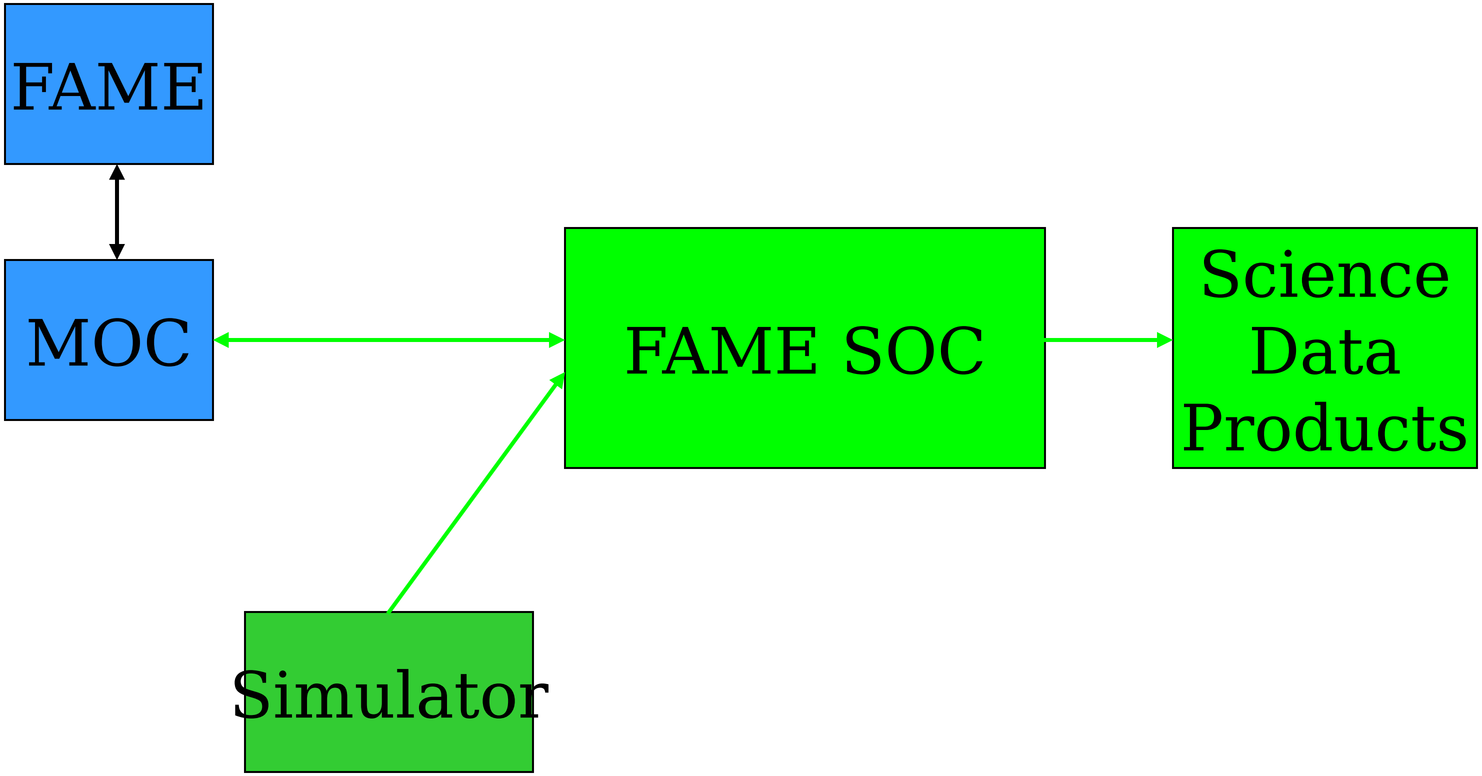
Agenda

- Introduction
- PDR Preparation
- Documentation
- Risk Management
- Schedule

United States Naval Observatory

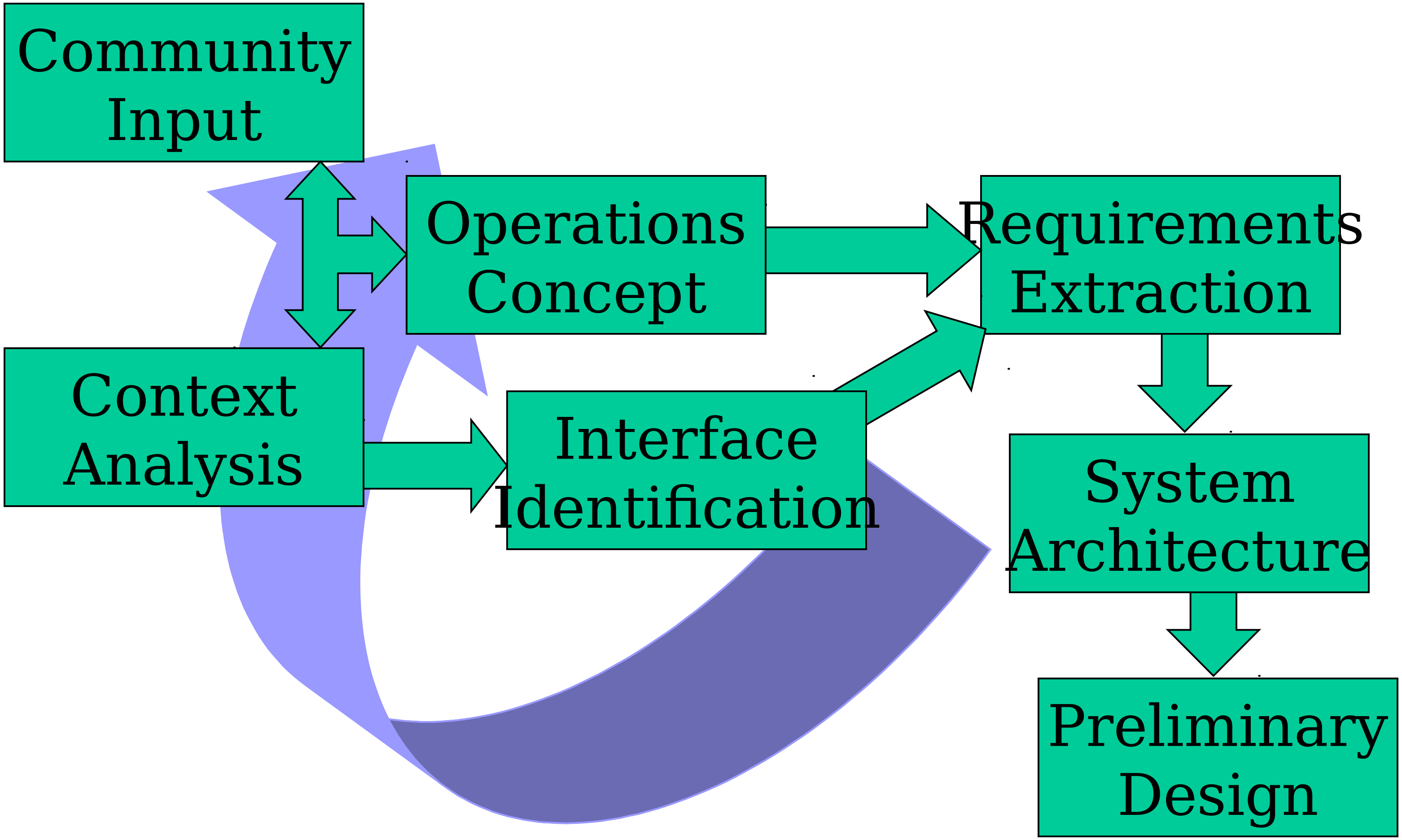
Introduction (Scope)

Full-sky Astrometric Mapping Explorer
U.S. Naval Observatory



United States Naval Observatory

Introduction (Process)



Community Input

Operations Concept

Requirements Extraction

Context Analysis

Interface Identification

System Architecture

Preliminary Design

PDR Preparation

- Production of Five Review Documents
  - Concept of Operations
  - Requirements Specification
  - Software Development Plan
  - Preliminary Design
  - Interface Control Document (Draft)
- Risk Management
  - Identification of High-Risk Threats
  - Risk Mitigation Plan

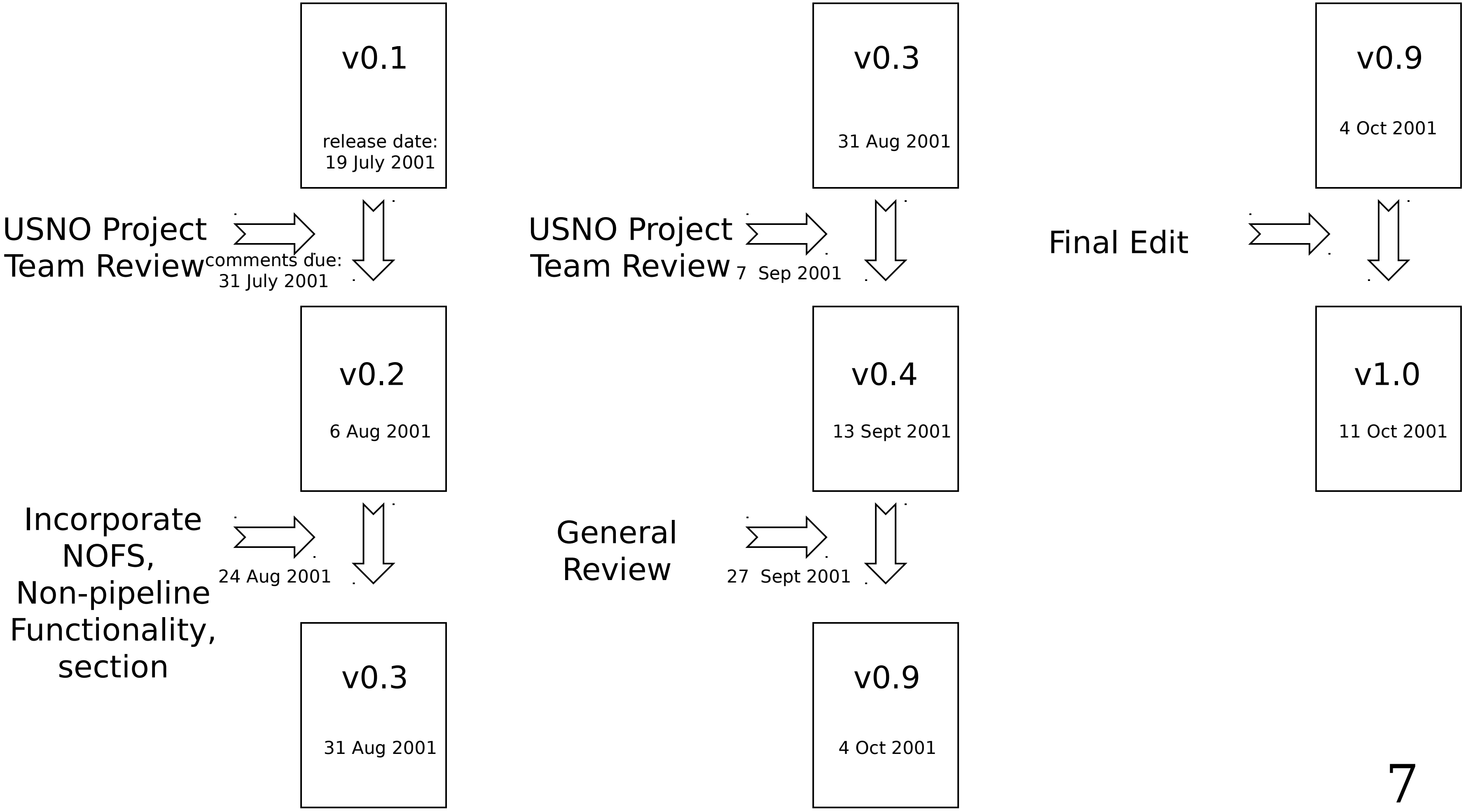
Documentation Development for PDR

MO & DA Quarterly Review

7/24/01

United States Naval Observatory

Operations Concept Document Evolution



v0.1

release date:
19 July 2001

USNO Project Team Review

comments due:
31 July 2001

v0.2

6 Aug 2001

Incorporate NOFS, Non-pipeline Functionality, section

24 Aug 2001

v0.3

31 Aug 2001

v0.3

31 Aug 2001

USNO Project Team Review

7 Sep 2001

v0.4

13 Sept 2001

General Review

27 Sept 2001

v0.9

4 Oct 2001

v0.9

4 Oct 2001

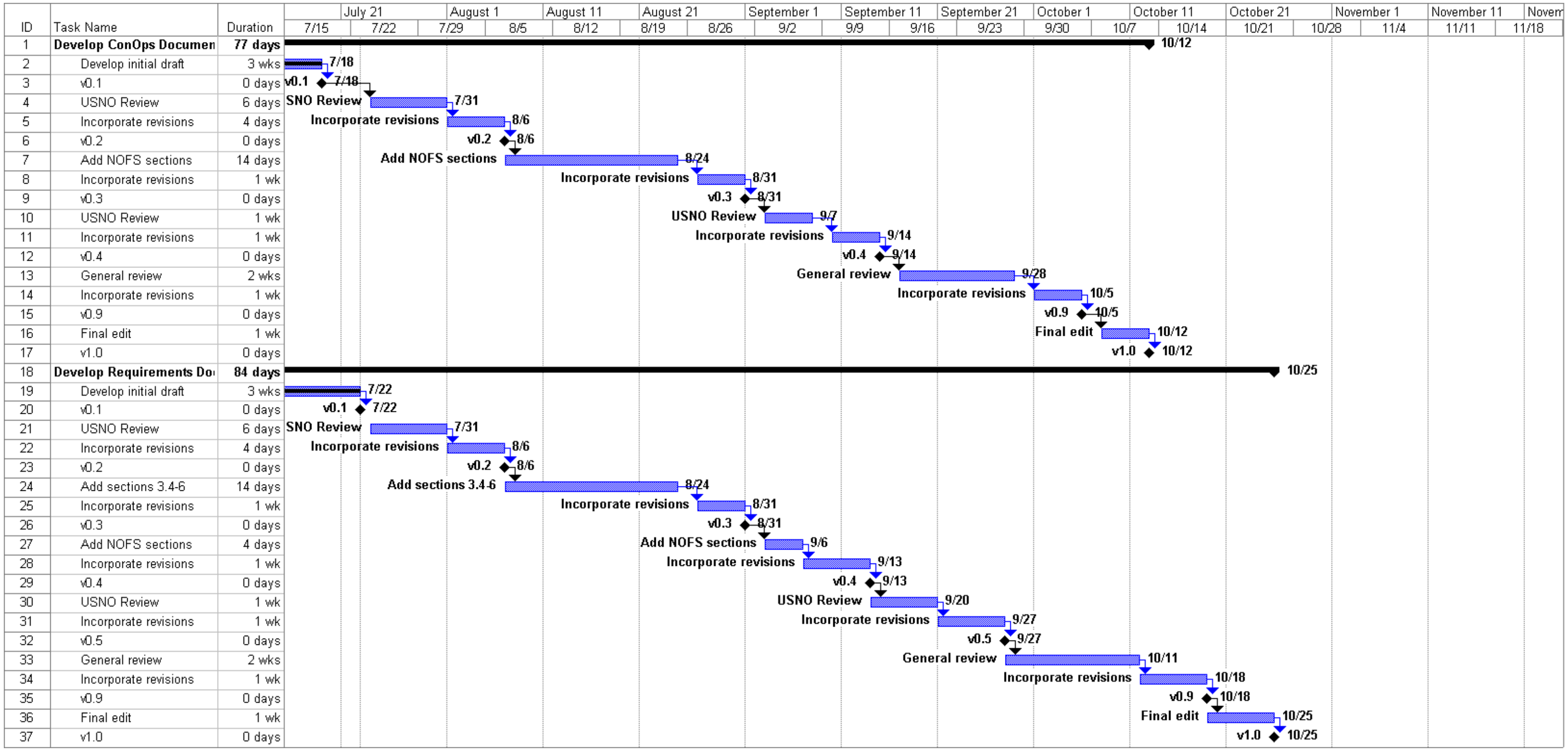
Final Edit

v1.0

11 Oct 2001

United States Naval Observatory

PDR Document Schedule

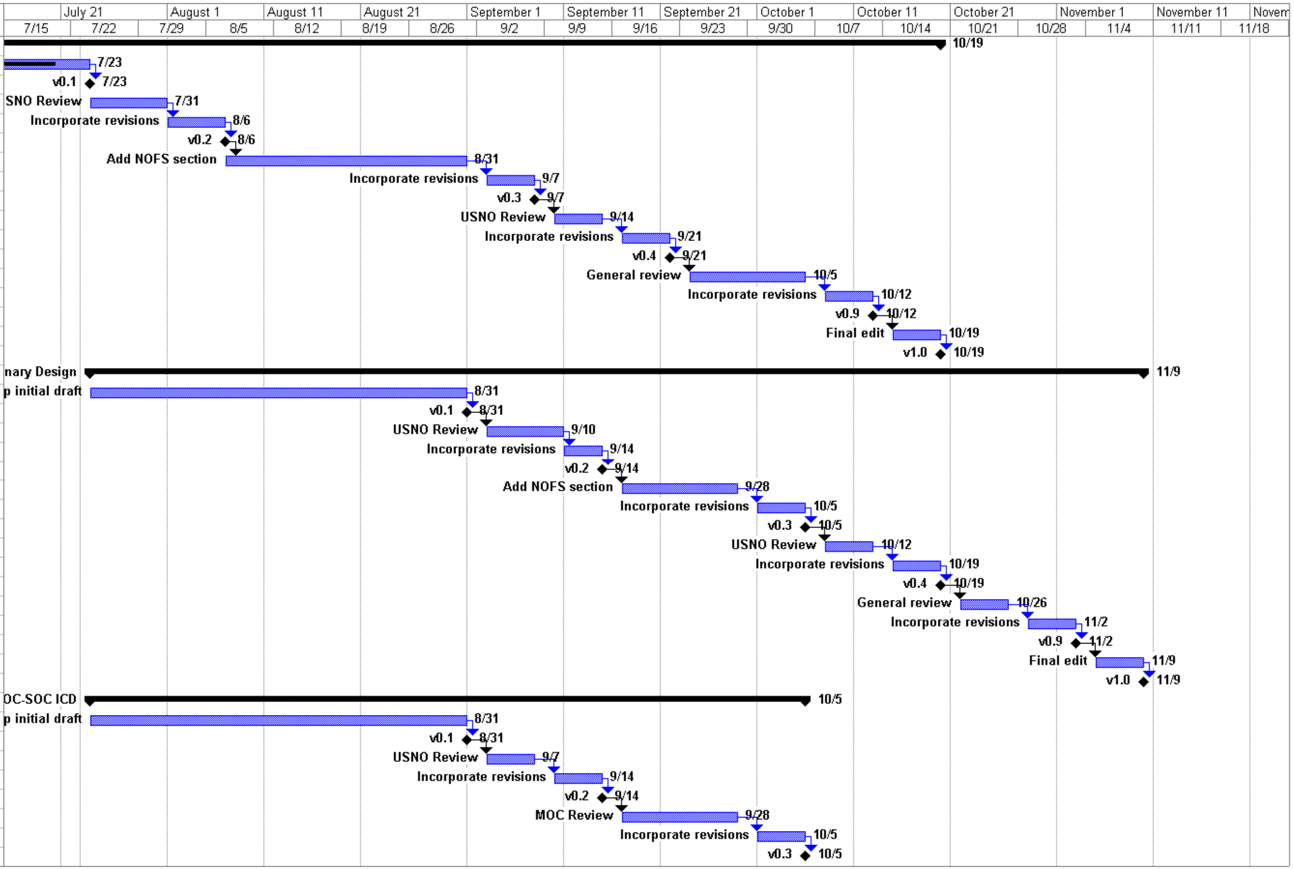


ID	Task Name	Duration
1	**Develop ConOps Documen**	**77 days**
2	Develop initial draft	3 wks
3	v0.1	0 days
4	USNO Review	6 days
5	Incorporate revisions	4 days
6	v0.2	0 days
7	Add NOFS sections	14 days
8	Incorporate revisions	1 wk
9	v0.3	0 days
10	USNO Review	1 wk
11	Incorporate revisions	1 wk
12	v0.4	0 days
13	General review	2 wks
14	Incorporate revisions	1 wk
15	v0.9	0 days
16	Final edit	1 wk
17	v1.0	0 days
18	**Develop Requirements Do**	**84 days**
19	Develop initial draft	3 wks
20	v0.1	0 days
21	USNO Review	6 days
22	Incorporate revisions	4 days
23	v0.2	0 days
24	Add sections 3.4-6	14 days
25	Incorporate revisions	1 wk
26	v0.3	0 days
27	Add NOFS sections	4 days
28	Incorporate revisions	1 wk
29	v0.4	0 days
30	USNO Review	1 wk
31	Incorporate revisions	1 wk
32	v0.5	0 days
33	General review	2 wks
34	Incorporate revisions	1 wk
35	v0.9	0 days
36	Final edit	1 wk
37	v1.0	0 days

United States Naval Observatory

PDR Document Schedule (contd)

ID	Task Name	Duration
38	**Develop Software Develop**	**80 days**
39	Develop initial draft	3.2 wks
40	v0.1	0 days
41	USNO Review	6 days
42	Incorporate revisions	4 days
43	v0.2	0 days
44	Add NOFS section	19 days
45	Incorporate revisions	1 wk
46	v0.3	0 days
47	USNO Review	1 wk
48	Incorporate revisions	1 wk
49	v0.4	0 days
50	General review	2 wks
51	Incorporate revisions	1 wk
52	v0.9	0 days
53	Final edit	1 wk
54	v1.0	0 days
55	**Develop Preliminary Desig**	**79 days**
56	Develop initial draft	29 days
57	v0.1	0 days
58	USNO Review	6 days
59	Incorporate revisions	4 days
60	v0.2	0 days
61	Add NOFS section	10 days
62	Incorporate revisions	1 wk
63	v0.3	0 days
64	USNO Review	1 wk
65	Incorporate revisions	1 wk
66	v0.4	0 days
67	General review	1 wk
68	Incorporate revisions	1 wk
69	v0.9	0 days
70	Final edit	1 wk
71	v1.0	0 days
72	**Develop MOC-SOC ICD**	**54 days**
73	Develop initial draft	29 days
74	v0.1	0 days
75	USNO Review	5 days
76	Incorporate revisions	5 days
77	v0.2	0 days
78	MOC Review	2 wks
79	Incorporate revisions	1 wk
80	v0.3	0 days



SOC Concept of Operations

MO & DA Quarterly Review

7/23/01

United States Naval Observatory

Concept of Operations Status

- Based on:
  - MRD, SRD, Calibration Plan (draft)
  - Interviews with MO & DA personnel
- Purpose
  - Produce a conceptual description of a system that meets program level requirements
  - Serve as a basis for deriving system-level functional and performance requirements
- Draft version 0.1 released 19 July 2001
  - Intended for internal (USNO) review only
  - Does not include:
    - Simulator
    - Non-pipeline operations
  - Closure date for comments: 31 July 2001

Concept of Operations Status (contd)

- Version 0.3 will include Simulator, non-pipeline operations
  - Closure date: 24 August 2001
- Version 1.0 target release date 11 October 2001

United States Naval Observatory

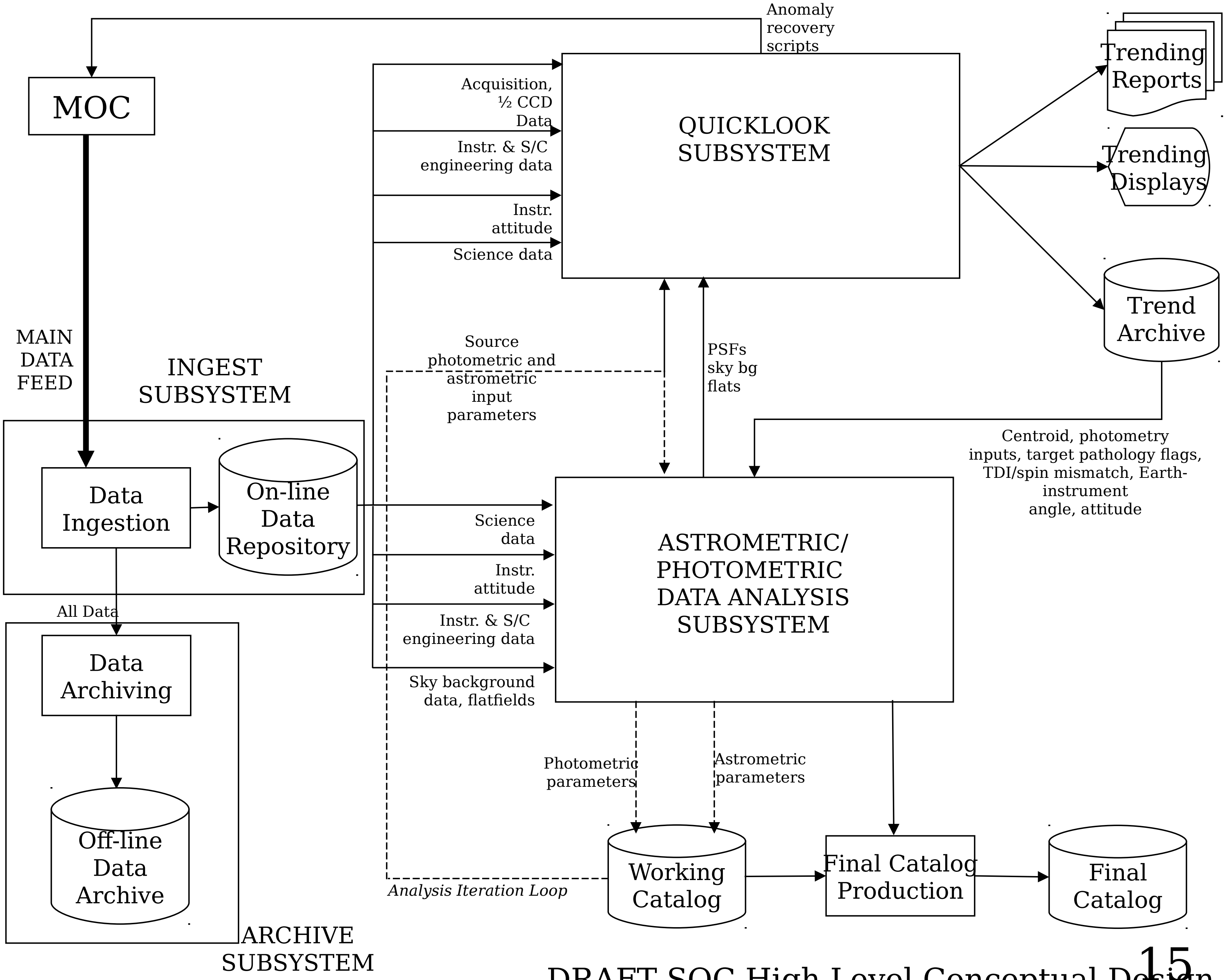
Concept of Operations

Full-sky Astrometric Mapping Explorer
U.S. Naval Observatory

- SOC Data Processing System is divided into four subsystems:
  - Data ingestion
  - Data archiving
  - Quicklook
  - Astrometric and Photometric Data Analysis

Data Ingestion, Data Archiving Subsystems

- Data Ingestion
  - Monitors staging area
  - Makes ingested data accessible to other three subsystems
- Data Archiving
  - All data received from MOC is copied to permanent storage medium (DVD)
  - Entry made into archiving database
  - Intended for problem recovery



MOC

Anomaly recovery scripts

MAIN DATA FEED

INGEST SUBSYSTEM

Data Ingestion

On-line Data Repository

All Data

Data Archiving

Off-line Data Archive

ARCHIVE SUBSYSTEM

Acquisition, ½ CCD Data

Instr. & S/C engineering data

Instr. attitude

Science data

QUICKLOOK SUBSYSTEM

Trending Reports

Trending Displays

Trend Archive

Source photometric and astrometric input parameters

PSFs sky bg flats

Centroid, photometry inputs, target pathology flags, TDI/spin mismatch, Earth-instrument angle, attitude

Science data

Instr. attitude

Instr. & S/C engineering data

Sky background data, flatfields

ASTROMETRIC/ PHOTOMETRIC DATA ANALYSIS SUBSYSTEM

Photometric parameters

Astrometric parameters

Analysis Iteration Loop

Working Catalog

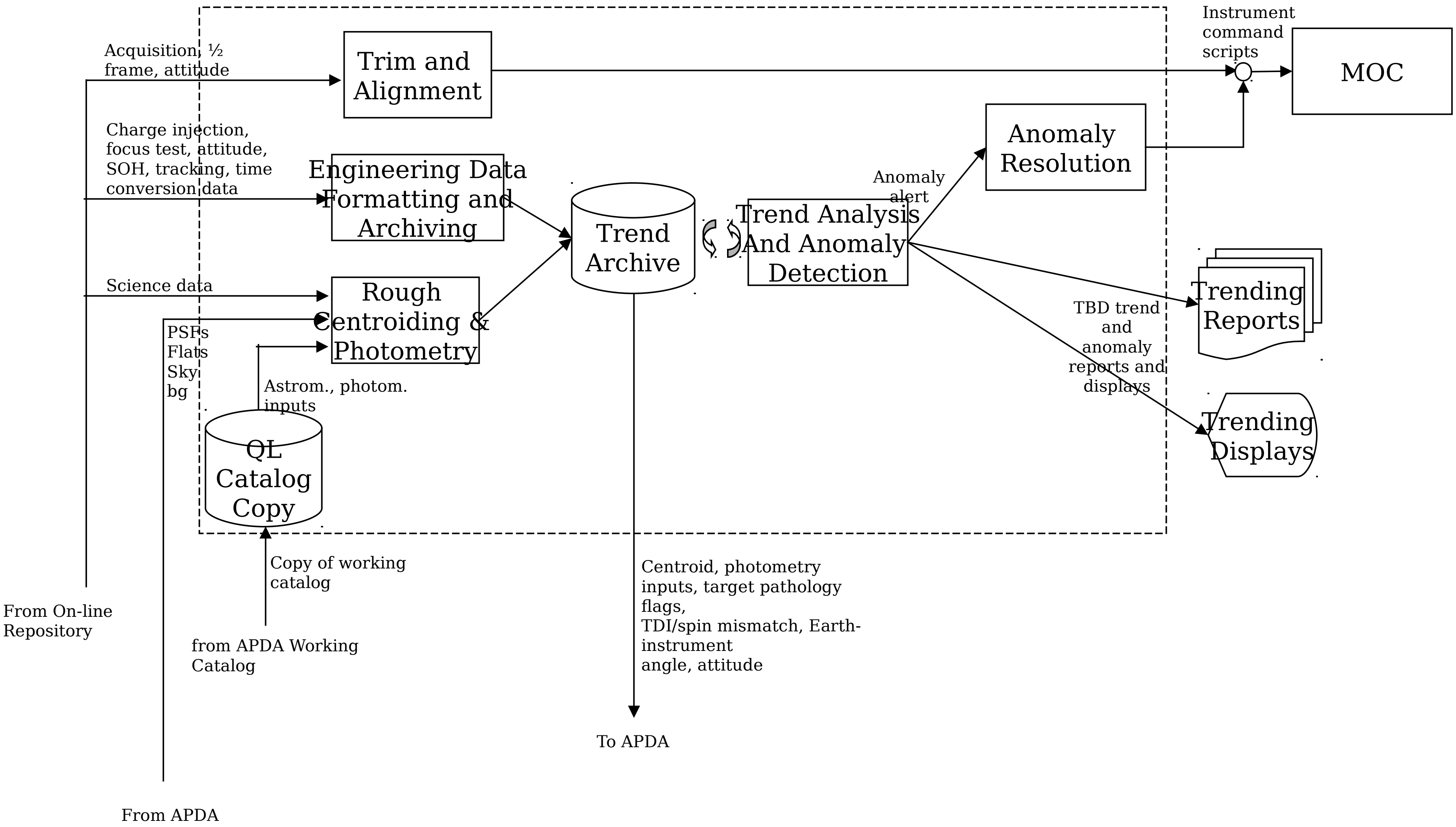
Final Catalog Production

Final Catalog

Quicklook

- Purpose:
  - Instrument/spacecraft anomaly detection
  - Trend history
  - Support trim/alignment procedure
  - Generate centroiding starting points

QUICKLOOK SUBSYSTEM



Acquisition, ½ frame, attitude

Trim and Alignment

Instrument command scripts

MOC

Charge injection, focus test, attitude, SOH, tracking, time conversion data

Engineering Data Formatting and Archiving

Anomaly Resolution

Anomaly alert

Trend Archive

Trend Analysis And Anomaly Detection

Science data

Rough Centroiding & Photometry

PSFs Flats Sky bg

Astrom., photom. inputs

QL Catalog Copy

TBD trend and anomaly reports and displays

Trending Reports

Trending Displays

Copy of working catalog

from APDA Working Catalog

From On-line Repository

Centroid, photometry inputs, target pathology flags, TDI/spin mismatch, Earth-instrument angle, attitude

To APDA

From APDA

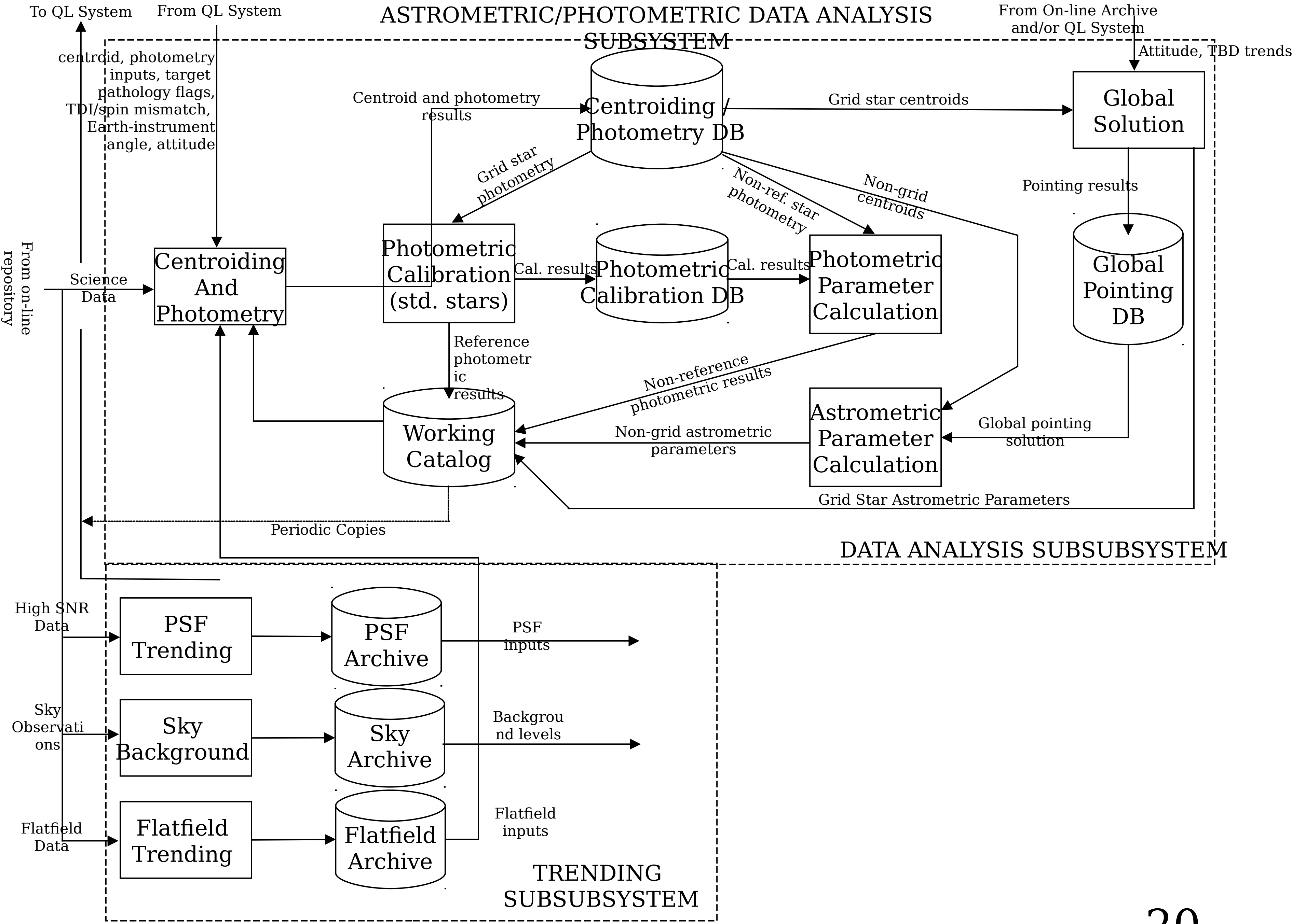
QL Questions, Issues

- What are the centroiding outputs?
- How are potential source pathologies identified?
  - Astrometric
  - Photometric
- What are the parameters that will be monitored?
- What are the anomaly condition indicators?
  - Out of bounds
  - Singularities
- Anomaly recovery procedures are TBD
- Trending, anomaly reports and displays are TBD

APDA

- Pupose
  - Science data reduction
  - Analysis-intensive trending
    - PSF
    - Sky background
    - Flat fielding

ASTROMETRIC/PHOTOMETRIC DATA ANALYSIS SUBSYSTEM



To QL System

From QL System

From On-line Archive and/or QL System

Attitude, TBD trends

centroid, photometry inputs, target pathology flags, TDI/spin mismatch, Earth-instrument angle, attitude

Centroid and photometry results

Centroiding / Photometry DB

Grid star centroids

Global Solution

Grid star photometry

Non-ref. star photometry

Non-grid centroids

Pointing results

From on-line repository

Science Data

Centroiding And Photometry

Photometric Calibration (std. stars)

Cal. results

Photometric Calibration DB

Cal. results

Photometric Parameter Calculation

Global Pointing DB

Reference photometric results

Non-reference photometric results

Working Catalog

Non-grid astrometric parameters

Astrometric Parameter Calculation

Global pointing solution

Grid Star Astrometric Parameters

Periodic Copies

DATA ANALYSIS SUBSUBSYSTEM

High SNR Data

PSF Trending

PSF Archive

PSF inputs

Sky Observations

Sky Background

Sky Archive

Background levels

Flatfield Data

Flatfield Trending

Flatfield Archive

Flatfield inputs

TRENDING SUBSUBSYSTEM

APDA Questions, Issues

- Trending subsystem: does it belong in QL or APDA?
- Trending Issues: How are we going to do these?
  - PSF-Archive-Centroiding
  - Sky background-Archives-Centroiding
  - Flatfielding-Archive-Centroiding
- Centroiding needs to be worked out
  - Inputs, outputs
  - Feasibility
- Global Solution
  - There is a lot of stuff inside the GS process—basic feasibility of solution needs to be shown
- Photometric calibration
- Prototyping has concentrated on the Global Solution process
  - May want to direct some prototyping effort to other technical risk areas

Requirements Status

MO & DA Review

7/23/01

SOC Requirements Status

- Based directly on SOC Concept of Operations v0.1
  - Projection of ConOps into “functional requirements space”
  - More important at this point in time to review ConOps document closely
- Purpose:
  - To produce a baseline set of functional requirements
    - System design proceeds from this baseline set
  - To provide a mechanism for traceability between source (high level) requirements and design elements
    - Ensures that all high-level requirements are being met by the design
  - To provide the set of test cases against which the implemented system can be tested
  - To set priorities for design and development
- Draft version 0.1 released 22 July 2001
  - Intended for internal (USNO) review only
  - Does not include:
    - Simulator
    - Non-pipeline operations
  - Closure date for comments: 31 July 2001

SOC Requirements Status (contd)

- Version 0.3 will include Simulator, non-pipeline operations
  - Closure date: 6 Sept 2001
- Version 1.0 target release date 25 October 2001

United States Naval Observatory

Full-sky Astrometric Mapping Explorer
U.S. Naval Observatory

MOC-SOC ICD
Status

MO & DA Quarterly Review

MOC-SOC ICD Status

- Purpose
  - Explicitly define the interface between the MOC and SOC
    - File types, formats, sizes, frequency, connection interruption recovery procedures, *etc.*
  - Can effectively be used to define Simulator-Pipeline interface
- Initial draft target date: 31 August 2001
- Version 1: CDR

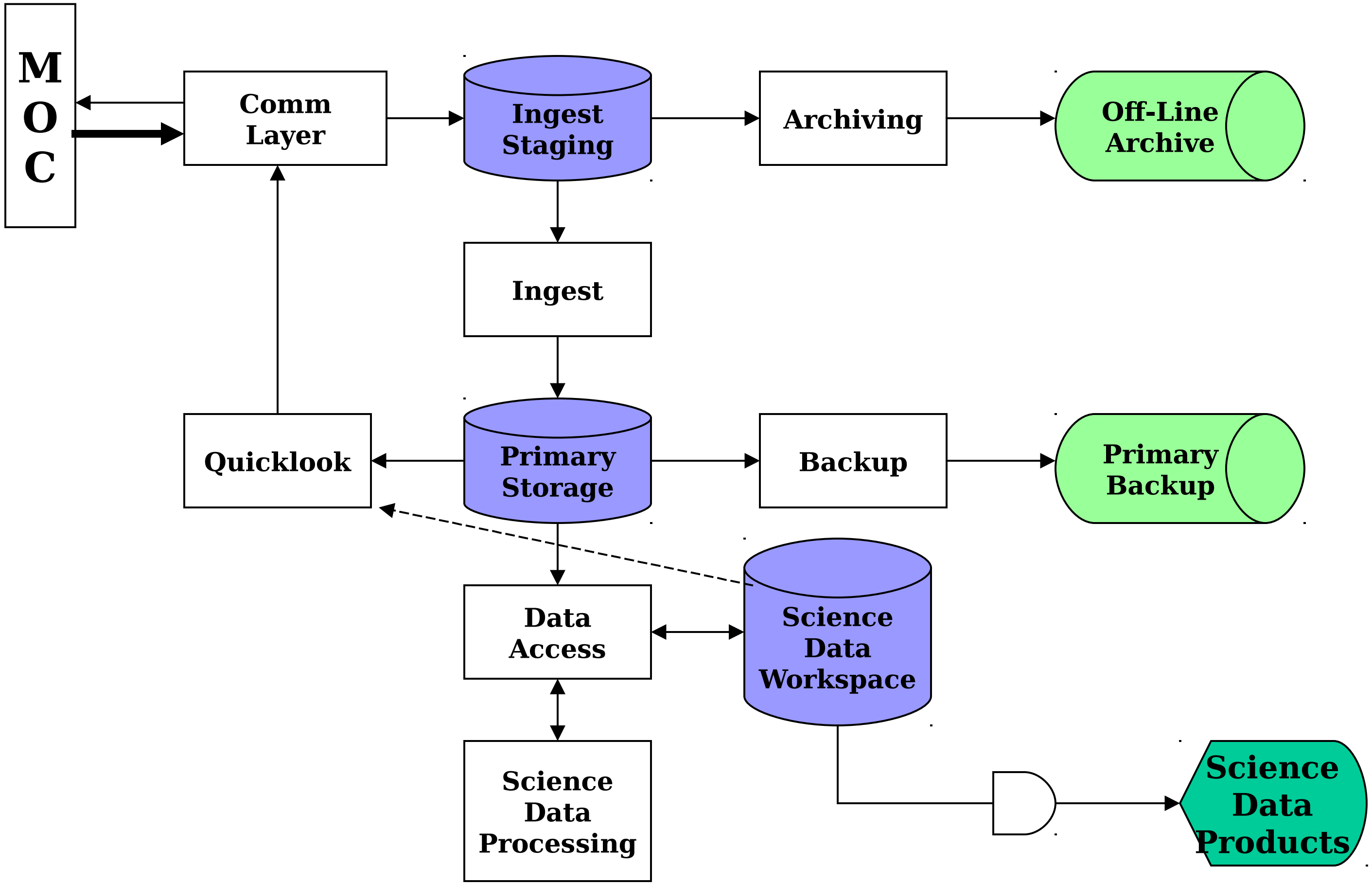
MOC-SOC ICD:
Issues

- MOC “push” vs. SOC “pull”
  - Initial inclination: MOC push
- Telemetry stream vs. discrete file delivery
  - Initial inclination: discrete file delivery
  - Initial list of file types:
    - Science Data files (10 second segment)
    - Full Frame file (individual CCD half)
    - Acquisition file (individual 600x600 window)
    - Charge Injection Test file (individual test profile)
    - Catalog Dump file (individual catalog dump)
    - Focus Test file (individual focus test)
    - Instrument Attitude file (10 second segment)
    - SOH file (10 second segment)
    - Ground Station Tracking file (10 second segment)
    - Time Conversion file (valid over 10 minute span)

Software Development Plan

- Outlines the Process for Producing Quality Software
  - System Overview
  - General Policies
  - Specific Development Plan
  - Risk Management
  - Configuration Management / Quality Assurance
  - Resource Analysis / Schedule
- Work-in-Progress
  - Available for Review in Early August
  - Version 1.0 Delivered at PDR

Preliminary Design



MOC

Comm Layer

Ingest Staging

Archiving

Off-Line Archive

Ingest

Quicklook

Primary Storage

Backup

Primary Backup

Data Access

Science Data Workspace

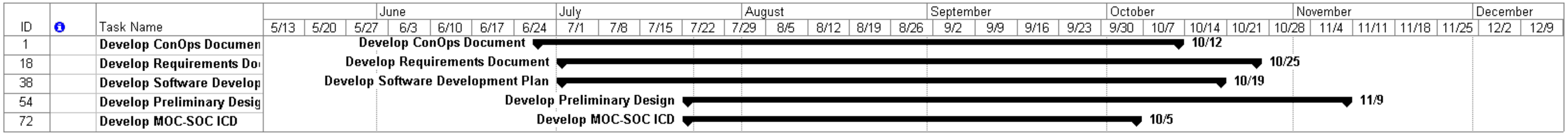
Science Data Processing

Science Data Products

Risk Management

- Cost = Schedule = Technical Risk
- Two Areas of Technical Risk
  - Data Flow
    - Examine Other Large Data Volume Processes
    - Seek Research and Industry Expertise
    - Prototype
  - Algorithm
    - Identify High-Risk Areas
    - Produce Prototypes and Test
    - Develop End-to-End Framework Early On

PDR Preparation Schedule



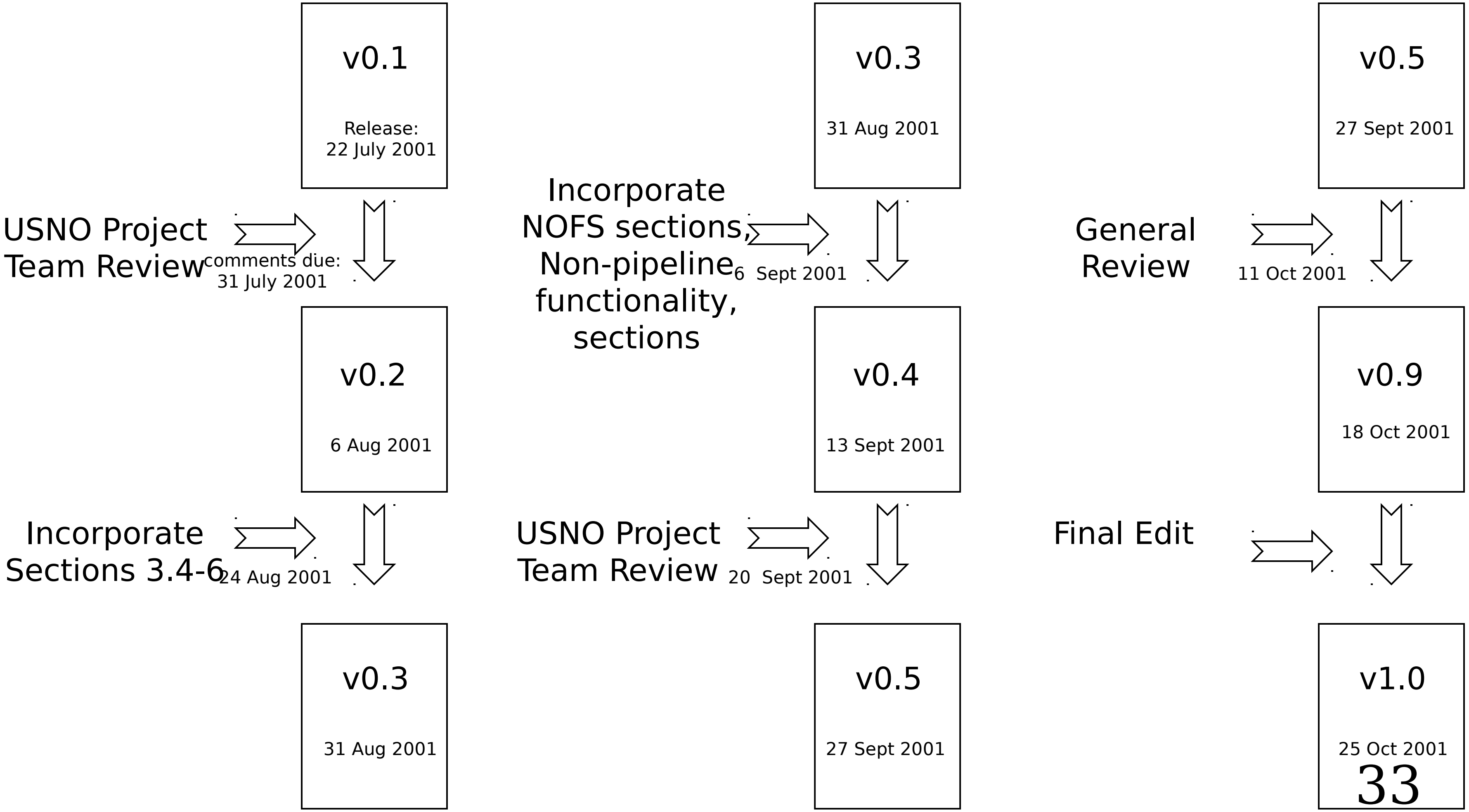
ID	ℹ	Task Name
1		Develop ConOps Documen
18		Develop Requirements Do
38		Develop Software Develop
54		Develop Preliminary Desig
72		Develop MOC-SOC ICD

- Puts us on track for PDR in Late Nov / Early Dec 01
- Allows ample time for integration with NOFS effort
- Need to assess priority on prototyping
- Need to address process and design issues
- Schedule allows time for comment and buy-in from all play
- PDR success is achieved before, not at, PDR

Backup Slides

United States Naval Observatory

Requirements Document Evolution



v0.1

Release:
22 July 2001

USNO Project Team Review

comments due:
31 July 2001

v0.2

6 Aug 2001

Incorporate Sections 3.4-6

24 Aug 2001

v0.3

31 Aug 2001

v0.3

31 Aug 2001

Incorporate NOFS sections, Non-pipeline functionality, sections

6 Sept 2001

v0.4

13 Sept 2001

USNO Project Team Review

20 Sept 2001

v0.5

27 Sept 2001

v0.5

27 Sept 2001

General Review

11 Oct 2001

v0.9

18 Oct 2001

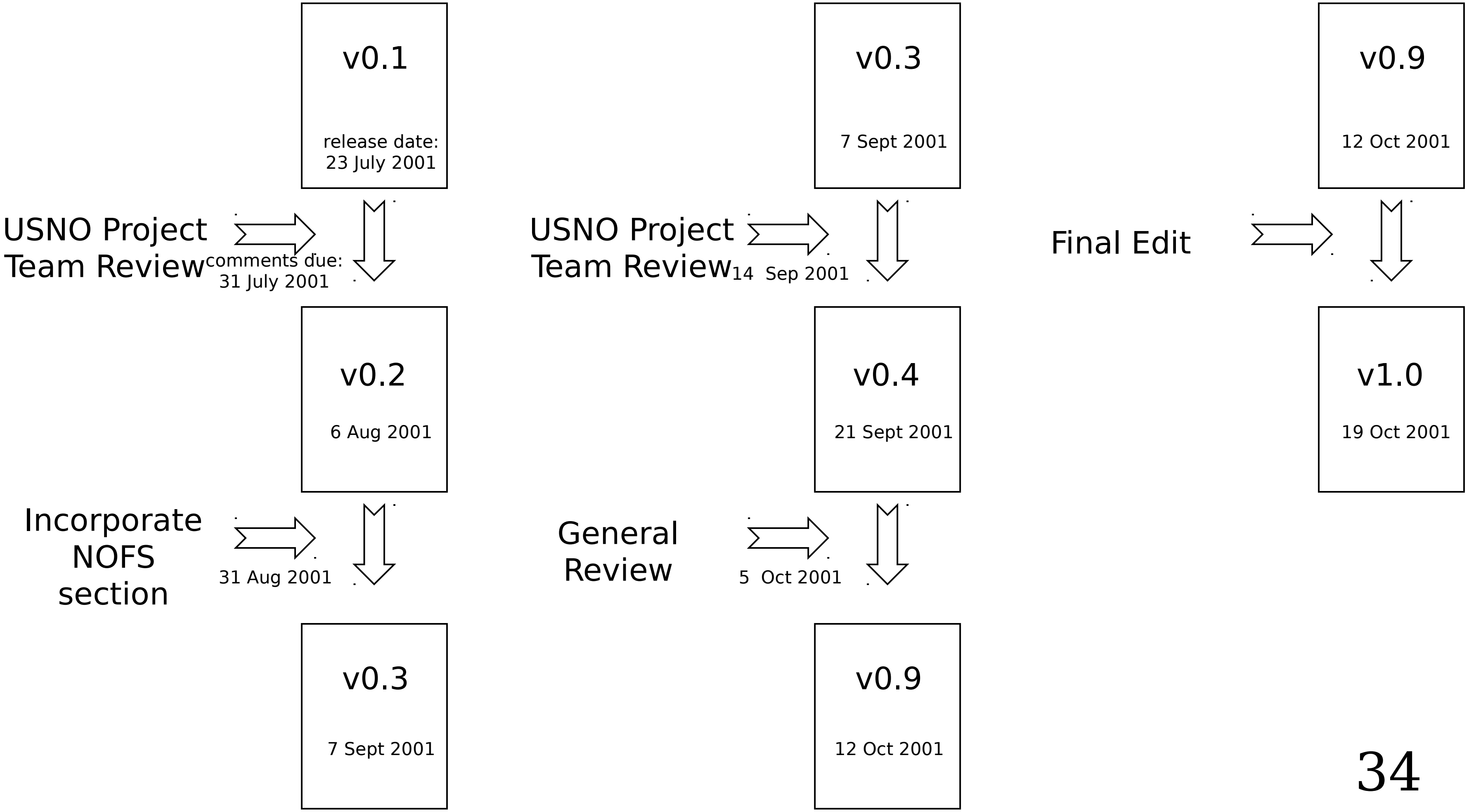
Final Edit

v1.0

25 Oct 2001

United States Naval Observatory

Software Development Plan Evolution



v0.1

release date:
23 July 2001

USNO Project Team Review

comments due:
31 July 2001

v0.2

6 Aug 2001

Incorporate NOFS section

31 Aug 2001

v0.3

7 Sept 2001

v0.3

7 Sept 2001

USNO Project Team Review

14 Sep 2001

v0.4

21 Sept 2001

General Review

5 Oct 2001

v0.9

12 Oct 2001

v0.9

12 Oct 2001

Final Edit

v1.0

19 Oct 2001

United States Naval Observatory

Preliminary Design Document Evolution

v0.1

release date:
31 Aug 2001

USNO Project Team Review

comments due:
7 Sept 2001

v0.2

14 Sept 2001

Incorporate NOFS section

28 Sept 2001

v0.3

5 Oct 2001

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v0.3

5 Oct 2001

USNO Project Team Review

12 Oct 2001

v0.4

19 Oct 2001

General Review

26 Oct 2001

v0.9

2 Nov 2001

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v0.9

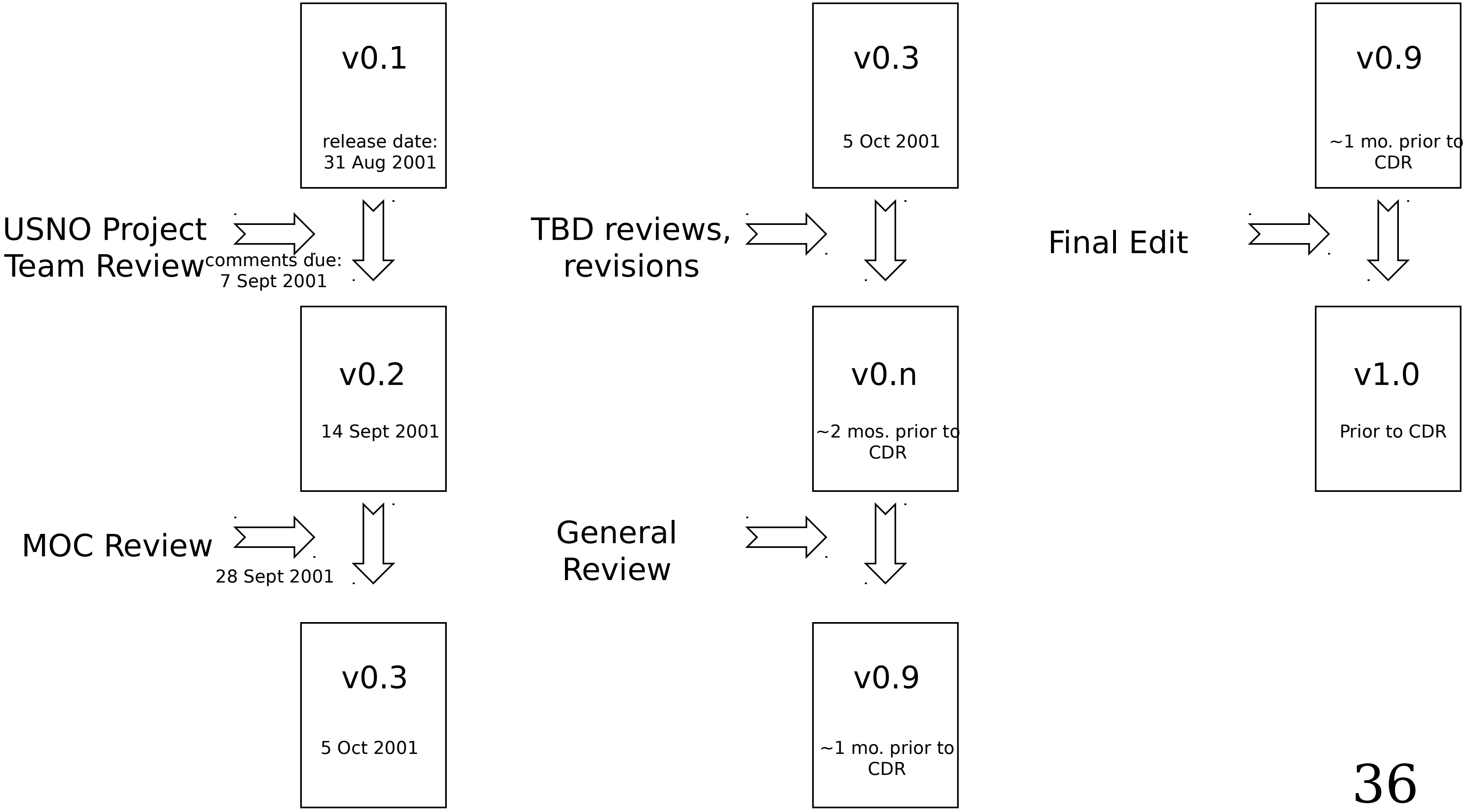
2 Nov 2001

Final Edit

v1.0

9 Nov 2001

MOC-SOC ICD Evolution



v0.1

release date:
31 Aug 2001

USNO Project Team Review

comments due:
7 Sept 2001

v0.2

14 Sept 2001

MOC Review

28 Sept 2001

v0.3

5 Oct 2001

v0.3

5 Oct 2001

TBD reviews, revisions

v0.n

~2 mos. prior to CDR

General Review

v0.9

~1 mo. prior to CDR

v0.9

~1 mo. prior to CDR

Final Edit

v1.0

Prior to CDR

QL: Anomaly Parameters

- QL trend shall generate running time histories of the following spacecraft and instrument operating parameters:
  - Image centroids vs. window centers
  - Standard deviation
  - Skewness
  - Kurtosis
  - TBD bimodality metric
  - TBD goodness-of-fit metric
  - Total counts per TBD reference stars
  - Total counts per CCD per unit time
  - TBD focus metric
  - TBD charge injection metric
  - Temperature
  - Power
  - Spin rate
  - Spin axis direction
  - Precession rate
  - Precession axis direction
  - Earth—instrument angle
  - TDI rate
  - TDI rate—spin rate difference
  - Observed attitude—model attitude difference
  - Observed profile widths—model profile widths difference
  - Observed counts—model counts difference